

**Jagdish Mehra
Helmut Rechenberg**

**THE HISTORICAL DEVELOPMENT
OF
QUANTUM THEORY**

VOLUME 2

**The Discovery of Quantum Mechanics
1925**



Springer

The Historical Development Of Quantum Theory Vol Ii

The Discovery Of Quantum Mechanics 1925

Mohsen Razavy



The Historical Development Of Quantum Theory Vol Ii The Discovery Of Quantum Mechanics 1925:

The Historical Development of Quantum Theory Jagdish Mehra, Helmut Rechenberg, 2000-12-28 Quantum Theory together with the principles of special and general relativity constitute a scientific revolution that has profoundly influenced the way in which we think about the universe and the fundamental forces that govern it The Historical Development of Quantum Theory is a definitive historical study of that scientific work and the human struggles that accompanied it from the beginning Drawing upon such materials as the resources of the Archives for the History of Quantum Physics the Niels Bohr Archives and the archives and scientific correspondence of the principal quantum physicists as well as Jagdish Mehra's personal discussions over many years with most of the architects of quantum theory the authors have written a rigorous scientific history of quantum theory in a deeply human context This multivolume work presents a rich account of an intellectual triumph a unique analysis of the creative scientific process The Historical Development of Quantum Theory is science history and biography all wrapped in the story of a great human enterprise Its lessons will be an aid to those working in the sciences and humanities alike

Constructing Quantum Mechanics Volume Two Michel Janssen, Anthony Duncan, 2023-08-17 This is the second of two volumes on the genesis of quantum mechanics in the first quarter of the 20th century It covers the period 1923-1927 After covering some of the difficulties the old quantum theory had run into by the early 1920s as well as the discovery of the exclusion principle and electron spin it traces the emergence of two forms of the new quantum mechanics matrix mechanics and wave mechanics in the years 1923-27 It then shows how the new theory took care of some of the failures of the old theory and put its successes on a more solid basis Finally it shows how in 1927 the two forms of the new theory were unified first through statistical transformation theory then through the Hilbert space formalism This volume provides a detailed analysis of the classic papers by Heisenberg Born Jordan Dirac De Broglie Einstein Schrödinger von Neumann and other authors Drawing on the correspondence of these and other physicists their later reminiscences and the extensive secondary literature on the quantum revolution this volume places these papers in the context of the discussions out of which modern quantum mechanics emerged It argues that the genesis of modern quantum mechanics can be seen as the construction of an arch on a scaffold provided by the old quantum theory discarded once the arch could support itself

The Historical Development of Quantum Theory Jagdish Mehra, 1982 *Old Quantum Theory and Early Quantum Mechanics* Marco Giliberti, Luisa Lovisetti, 2024-06-28 This book provides a historical presentation of Old Quantum Theory and early Quantum Mechanics integrated with comments and examples that help contextualize and understand the physics discussed It consists in a detailed analysis of the usual topics that have most contributed to the birth and the development of Quantum Mechanics black body spectrum atomic models EPR paradox etc but also dealing with ideas concepts and results that are not usually treated vortex atoms discussion on the meaning of the term electron non quantum models of the Compton effect etc The time span taken into consideration goes mainly from the 1880s to the 1940s but some

brief notes on more recent results are also presented in the appendixes The work is based on nearly 800 original documents books papers letters newspapers whose content is not only partially reported but also explained and inserted in the historical social and disciplinary context of the time Together with a rigorous historical framework the book offers also an educational discussion of the physical aspects presented Indeed there are some specific sections and subsections with pedagogical observations This book is intended for students pursuing STEM degrees particularly those seeking an understanding of the genesis and rationale behind quantum mechanics But it is surely also addressed to professional physicists who are eager to reconsider the cultural foundations underlying the quantum view of the world We are thus thinking of inquiring minds people who teach quantum physics and individuals involved in quantum technologies

Quantum Concepts in Physics Malcolm Longair, 2013-01-31 Written for advanced undergraduates physicists and historians and philosophers of physics this book tells the story of the development of our understanding of quantum phenomena through the extraordinary years of the first three decades of the twentieth century Rather than following the standard axiomatic approach this book adopts a historical perspective explaining clearly and authoritatively how pioneers such as Heisenberg Schrodinger Pauli and Dirac developed the fundamentals of quantum mechanics and merged them into a coherent theory and why the mathematical infrastructure of quantum mechanics has to be as complex as it is The author creates a compelling narrative providing a remarkable example of how physics and mathematics work in practice The book encourages an enhanced appreciation of the interaction between mathematics theory and experiment helping the reader gain a deeper understanding of the development and content of quantum mechanics than any other text at this level

Quantum: Einstein, Bohr, and the Great Debate about the Nature of Reality Manjit Kumar, 2010-05-24 A lucid account of quantum theory and why you should care combined with a gripping narrative San Francisco Chronicle Quantum theory is weird As Niels Bohr said if you weren't shocked by quantum theory you didn't really understand it For most people quantum theory is synonymous with mysterious impenetrable science And in fact for many years it was equally baffling for scientists themselves In this tour de force of science history Manjit Kumar gives a dramatic and superbly written account of this fundamental scientific revolution focusing on the central conflict between Einstein and Bohr over the nature of reality and the soul of science This revelatory book takes a close look at the golden age of physics the brilliant young minds at its core and how an idea ignited the greatest intellectual debate of the twentieth century

The Historical Development of Quantum Theory Jagdish Mehra, 1982 Constructing Quantum Mechanics Anthony Duncan, Michel Janssen, 2019-08-29 Constructing Quantum Mechanics is the first of two volumes on the genesis of quantum mechanics This volume traces the early contributions by Planck Einstein and Bohr all showing the need for drastic changes to the physics of their day It examines the efforts by Sommerfeld and others to develop a new theory now known as the old quantum theory After some striking successes this theory ran into serious difficulties and ended up serving as the scaffold on which the arch of modern quantum mechanics was built This volume breaks new ground both in its

treatment of the work of Sommerfeld and his associates and by offering new perspectives on classic papers by Planck Einstein Bohr and others Paying close attention to both primary and secondary sources Constructing Quantum Mechanics provides an in depth analysis of the heroic struggle to come to terms with the wealth of mostly spectroscopic data that eventually gave us modern quantum mechanics

Classical Mechanics and Quantum Mechanics: An Historic-Axiomatic Approach Peter Enders, 2019-09-05 This unique textbook presents a novel axiomatic pedagogical path from classical to quantum physics Readers are introduced to the description of classical mechanics which rests on Euler's and Helmholtz's rather than Newton's or Hamilton's representations Special attention is given to the common attributes rather than to the differences between classical and quantum mechanics Readers will also learn about Schrödinger's forgotten demands on quantization his equation Einstein's idea of quantization as selection problem The Schrödinger equation is derived without any assumptions about the nature of quantum systems such as interference and superposition or the existence of a quantum of action h The use of the classical expressions for the potential and kinetic energies within quantum physics is justified Key features Presents extensive reference to original texts Includes many details that do not enter contemporary representations of classical mechanics although these details are essential for understanding quantum physics Contains a simple level of mathematics which is seldom higher than that of the common Riemannian integral Brings information about important scientists Carefully introduces basic equations notations and quantities in simple steps This book addresses the needs of physics students teachers and historians with its simple easy to understand presentation and comprehensive approach to both classical and quantum mechanics

Heisenberg's 1925 "Umdeutung" Paper Marco Giliberti, Luisa Loviseti, 2025-07-31 This book presents a meticulously crafted new translation of Werner Heisenberg's ground breaking 1925 paper widely regarded as the birth certificate of quantum mechanics The translation remains faithful to the original terminology and is accompanied by a particularly detailed step by step commentary These annotations are designed not only to clarify the meaning of this complex work for the modern reader but also to illuminate the reasoning behind Heisenberg's choices offering deep insight into the physical conceptual and mathematical foundations of the theory Great care has been taken to make the calculations as explicit as possible while keeping them concise ensuring that every essential step is clear without unnecessary complexity This approach allows readers to grasp the logical flow of Heisenberg's argument while appreciating the elegance of his formulation Beyond the paper itself the book situates Heisenberg's work within the broader intellectual landscape of the time tracing the intense discussions and challenges in physics that led to the birth of quantum mechanics It also provides insight into the subsequent contributions of Born Jordan and Heisenberg himself that culminated in the formulation of matrix mechanics Aimed at readers with a university level background in quantum mechanics this book is an invaluable resource for those who wish to delve into the motivations conceptual developments and intricate reasoning that led Heisenberg to construct the new quantum theory in such a unique and revolutionary way

Understanding the Path from Classical to Quantum Mechanics Jaroslav Zamastil, 2023-07-27 The book is about the transition from classical to quantum mechanics covering the historical development of this great leap and explaining the concepts needed to understand it at a level suitable for undergraduate students The first part of the book summarizes classical electrodynamics and the Hamiltonian formulation of classical mechanics the two elements of classical physics which are crucial for understanding the classical to quantum transition The second part loosely traces the historical development of the classical to quantum transition starting with Einstein's 1916 derivation of the Planck radiation law continuing with the Ladenburg Kramers Born Heisenberg dispersion theory and ending with Heisenberg's magical 1925 paper which established quantum mechanics The purpose of the book is partly historical partly philosophical but mainly pedagogical It will appeal to a wide audience from undergraduate students for whom it can serve as a preparatory or supplementary text to standard textbooks to physicists and historians interested in the historical development of science [The Discovery of Quantum Mechanics 1925](#) Jagdish Mehra, Helmut Rechenberg, 2001-01-11 Quantum Theory together with the principles of special and general relativity constitute a scientific revolution that has profoundly influenced the way in which we think about the universe and the fundamental forces that govern it The Historical Development of Quantum Theory is a definitive historical study of that scientific work and the human struggles that accompanied it from the beginning Drawing upon such materials as the resources of the Archives for the History of Quantum Physics the Niels Bohr Archives and the archives and scientific correspondence of the principal quantum physicists as well as Jagdish Mehra's personal discussions over many years with most of the architects of quantum theory the authors have written a rigorous scientific history of quantum theory in a deeply human context This multivolume work presents a rich account of an intellectual triumph a unique analysis of the creative scientific process The Historical Development of Quantum Theory is science history and biography all wrapped in the story of a great human enterprise Its lessons will be an aid to those working in the sciences and humanities alike **David Hilbert and the Axiomatization of Physics (1898-1918)** L. Corry, 2013-06-29 David Hilbert 1862-1943 was the most influential mathematician of the early twentieth century and together with Henri Poincaré the last mathematical universalist His main known areas of research and influence were in pure mathematics algebra number theory geometry integral equations and analysis logic and foundations but he was also known to have some interest in physical topics The latter however was traditionally conceived as comprising only sporadic incursions into a scientific domain which was essentially foreign to his mainstream of activity and in which he only made scattered if important contributions Based on an extensive use of mainly unpublished archival sources the present book presents a totally fresh and comprehensive picture of Hilbert's intense original well informed and highly influential involvement with physics that spanned his entire career and that constituted a truly main focus of interest in his scientific horizon His program for axiomatizing physical theories provides the connecting link with his research in more purely mathematical fields especially geometry and a unifying point of view from which to

understand his physical activities in general In particular the now famous dialogue and interaction between Hilbert and Einstein leading to the formulation in 1915 of the generally covariant field equations of gravitation is adequately explored here within the natural context of Hilbert's overall scientific world view This book will be of interest to historians of physics and of mathematics to historically minded physicists and mathematicians and to philosophers of science

Philosophy of Physics Jeremy Butterfield, John Earman, 2007 The ambition of this volume is twofold to provide a comprehensive overview of the field and to serve as an indispensable reference work for anyone who wants to work in it For example any philosopher who hopes to make a contribution to the topic of the classical quantum correspondence will have to begin by consulting Klaas Landsman's chapter The organization of this volume as well as the choice of topics is based on the conviction that the important problems in the philosophy of physics arise from studying the foundations of the fundamental theories of physics It follows that there is no sharp line to be drawn between philosophy of physics and physics itself Some of the best work in the philosophy of physics is being done by physicists as witnessed by the fact that several of the contributors to the volume are theoretical physicists viz Ellis Emch Harvey Landsman Rovelli t Hooft the last of whom is a Nobel laureate Key features Definitive discussions of the philosophical implications of modern physics Masterly expositions of the fundamental theories of modern physics Covers all three main pillars of modern physics relativity theory quantum theory and thermal physics Covers the new sciences grown from these theories for example cosmology from relativity theory and quantum information and quantum computing from quantum theory Contains special Chapters that address crucial topics that arise in several different theories such as symmetry and determinism Written by very distinguished theoretical physicists including a Nobel Laureate as well as by philosophers Definitive discussions of the philosophical implications of modern physics Masterly expositions of the fundamental theories of modern physics Covers all three main pillars of modern physics relativity theory quantum theory and thermal physics Covers the new sciences that have grown from these theories for example cosmology from relativity theory and quantum information and quantum computing from quantum theory Contains special Chapters that address crucial topics that arise in several different theories such as symmetry and determinism Written by very distinguished theoretical physicists including a Nobel Laureate as well as by philosophers

Quantum Mechanics in Simple Matrix Form Thomas F. Jordan, 2012-05-23 With this text basic quantum mechanics becomes accessible to undergraduates with no background in mathematics beyond algebra Includes more than 100 problems and 38 figures 1986 edition

The Formulation of Matrix Mechanics and Its Modifications 1925-1926 Jagdish Mehra, Helmut Rechenberg, 1982-11-15 Quantum Theory together with the principles of special and general relativity constitute a scientific revolution that has profoundly influenced the way in which we think about the universe and the fundamental forces that govern it The Historical Development of Quantum Theory is a definitive historical study of that scientific work and the human struggles that accompanied it from the beginning Drawing upon such materials as the resources of the Archives for the History of Quantum

Physics the Niels Bohr Archives and the archives and scientific correspondence of the principal quantum physicists as well as Jagdish Mehra's personal discussions over many years with most of the architects of quantum theory the authors have written a rigorous scientific history of quantum theory in a deeply human context This multivolume work presents a rich account of an intellectual triumph a unique analysis of the creative scientific process The Historical Development of Quantum Theory is science history and biography all wrapped in the story of a great human enterprise Its lessons will be an aid to those working in the sciences and humanities alike

Heligoland Jan Rüger, 2017 The story of Heligoland the North Sea island which for generations stood as a symbol of Anglo German conflict A fascinating microcosm of a long and often troubled relationship covering two centuries and two world wars

Part 2 The Creation of Wave Mechanics; Early Response and Applications 1925-1926 Erwin Schrödinger, 1987-10-19 Quantum Theory together with the principles of special and general relativity constitute a scientific revolution that has profoundly influenced the way in which we think about the universe and the fundamental forces that govern it The Historical Development of Quantum Theory is a definitive historical study of that scientific work and the human struggles that accompanied it from the beginning Drawing upon such materials as the resources of the Archives for the History of Quantum Physics the Niels Bohr Archives and the archives and scientific correspondence of the principal quantum physicists as well as Jagdish Mehra's personal discussions over many years with most of the architects of quantum theory the authors have written a rigorous scientific history of quantum theory in a deeply human context This multivolume work presents a rich account of an intellectual triumph a unique analysis of the creative scientific process The Historical Development of Quantum Theory is science history and biography all wrapped in the story of a great human enterprise Its lessons will be an aid to those working in the sciences and humanities alike

Heisenberg's Quantum Mechanics Mohsen Razavy, 2011-01-20 This book provides a detailed account of quantum theory with a much greater emphasis on the Heisenberg equations of motion and the matrix method No other texts have come close to discuss quantum theory in terms of depth of coverage The book features a deeper treatment of the fundamental concepts such as the rules of constructing quantum mechanical operators and the classical quantum correspondence the exact and approximate methods based on the Heisenberg equations the determinantal approach to the scattering theory and the LSZ reduction formalism where the latter method is used to obtain the transition matrix The uncertainty relations for a number of different observables are derived and discussed A comprehensive chapter on the quantization of systems with nonlocalized interaction is included Exact solvable models and approximate techniques for solution of realistic many body problems are also considered The book takes a unified look in the final chapter examining the question of measurement in quantum theory with an introduction to the Bell's inequalities

Quantum Manjit Kumar, One of the best guides yet to the central conundrums of modern physics John Banville Quantum theory is weird As Niels Bohr said if you weren't shocked by quantum theory you didn't really understand it For most people quantum theory is synonymous with mysterious impenetrable science And in fact for

many years it was equally baffling for scientists themselves In this tour de force of science history Manjit Kumar gives a dramatic and superbly written account of this fundamental scientific revolution focusing on the central conflict between Einstein and Bohr over the nature of reality and the soul of science This revelatory book takes a close look at the golden age of physics the brilliant young minds at its core and how an idea ignited the greatest intellectual debate of the twentieth century

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